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ABSTRACT

This synthesis of the main trends and issues in the use of the new information technologies in education is based on background reports prepared for an Organisation for Economic Cooperation and Development (OECD) conference held in 1984. Topics discussed include: (1) the challenge posed by the educational potential of the new technologies and factors that will influence the response of education to this challenge; (2) the roles and responsibilities of member countries as they respond to the new information technologies, including national policy formation, policy objectives and priorities, industrial development links, and economic concerns; and (3) outcomes of educational policy and grassroots developments, including hardware/software use and variation in use by schools, computer science in the curriculum, impact of the technologies on learning, teacher roles and teacher training, and societal use patterns. An agenda for future work which is suggested to help education face the challenge of the new information technologies addresses such issues as the need for more hardware and software, the need for more evaluation data, the prevention of educational inequalities, and the importance of careful and coordinated policy planning. (MBR)

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International Conference on Education and New Information Technologies

Château de la Muette
9th-12th July 1984

EDUCATION AND NEW INFORMATION TECHNOLOGIES:

OVERALL TRENDS AND ISSUES

(Note by the Secretariat)

1. The attached, prepared by the Secretariat, presents a synthesis of the main trends and issues as they emerge from the background reports to the Conference. It will serve as an overall reference document to the discussions in both the Plenary Sessions and the Working Groups.

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I. CONTEXT

The Challenge of the New Information Technologies

1. In their hundred years of life, public systems of education have never ceased to undergo important developments. Their size, coverage and internal structure have changed. They have multiplied their objectives and the target groups have expanded and diversified. Yet very few of these changes have challenged the original principles of the organisation of education. Since the beginning, education has remained a labour intensive sector, employing almost exclusively specialised manpower on not so diversified tasks, with remarkably constant production methodologies and delivery systems. The current technological revolution (computer-based interactive devices, telecomunications) is pressing education towards yet further change. Once again the question is raised of how education can or indeed should respond and at what costs for its own functions and organisation. Obviously, the situation is not new to education nor does it necessarily constitute a problem for it. Theoretically, the system could respond to the pressure as in the past, by resisting it or by changing yet again what has been modified before, while leaving its basic organisational principles unaltered. Or else, it can engage in profound reshaping and remodelling, especially if the former types of response prove to be not entirely applicable in the present circumstances.

2. The analysis carried out within the CERI project on Education and the New Information Technologies has attempted to clear the ground for such a debate. Its central hypothesis recognises the situation as essentially new to education in a number of important aspects. First, the educational potential of the new generation of information technologies is larger than had been anticipated a decade ago on the basis of the computer-based teaching/learning methodologies developed at the time. The developments analysed within the project show that they could be more than a support tool for the teacher or a new subject in the curriculum. The new information technologies have also the potential to change education radically in its very structure and organisation, in terms of manpower (numbers, competence profiles, task diversity, etc.) and of production and delivery mechanisms.

The Web of Influences

3. The response of education to such potential -- and this is the second hypotesis in the analysis -- will necessarily reflect the powerful influence of a number of factors external to education. It cannot but reflect the penetration of the technologies in all spheres of society, of the awe, fear and expectations that this entails at all levels of the population, of the new learning needs that emerge as a consequence, of the new and urgent demands from the economy, for specialised manpower as well as for a larger market for

the new electronic products. The social, cultural and economic demands posed by new technologies of information as well as the attitudes towards these technologies all impinge on education. They raise forces and pressures to monitor and to stir educational courses so that new educational objectives can be defined and achieved in agreement with, or in support of, other new objectives, of a social, economic and political nature.

4. Faced with a challenge to its own functions and organisation and the interference of other non-educational forces, education could very well be tempted to resist the demand for "technological" change. Yet -- and this is the third hypothesis in the analysis -- it is debatable whether this attitude can be allowed to prevail. Education can hardly ignore this pressure for change. As part of the service sector, education is invested with the same imperatives as the rest of the sector, and indeed of the economy as a whole, forced to change and adapt to the new technological world, in order to remain financially viable. Next to the economic argument, which a number of educators could reject on the legitimate grounds that the functions of education cannot and should not be evaluated exclusively in financial terms, is the reality that education cannot ignore any large scale social change, without running the risk of loosing legitimacy as an institution and credibility as a service.

The Timing of the Technological Challenge

5. The task before education is a formidable one, its difficulties being increased by the timing of the challenge before it. The challenge of the technologies comes at a time of crisis for most educational systems. Few of the countries are likely to be in a position to tackle the "technological" issues serenely for some time. Few of the decision-makers in education will be spared the temptation to consider the technologies in relation to the crisis, i.e. to consider only those aspects of them which could be useful to find solution to the crisis -- rather than in relation to education, i.e., to look upon the full potential of the technologies for organising a possibly different, and better, service.

II. ROLES AND RESPONSIBILITIES

The Emergence of National Policies

6. By mid 1984, all Member countries are to be actively engaged and to have made progress in introducing the new information technologies in education. They all have achievements to show, and doubts to share, with other countries. In a number of them, experience has accumulated since the beginning of the 70s, when the technologies (mainly computer technology, essentially main frame computers) were first used for educational applications. No clear-cut consensus emerged then on the educational advantages of using these instead of "softer" teacher-based methodologies. During the past few years, and essentially under the impact of the new generations of computers -- the mini and microcomputers -- the educational involvment in the area has taken a new momentum in all countries. The alleged reasons are the cost/performance ratios of the new hardware, more favourable

than in the past, its potential for flexible and interactive use, its size, small enough to fit ordinary educational settings. At present, in a large -- and increasing -- number of Member countries, the developments have become important enough to warrant viewing the introduction of information technology in education as an object of coordinated development programmes, nationwide, under the responsibility of the public authorities.

Parallel Developments

7. Next to these more recent formal involvments -- usually reflected in coherent and exhaustive formulations of educational policy -- and as a continuation of the earlier phases of development, virtually each country has its own examples to show of important ongoing contributions from a variety of other sources. Next to state or regional educational authorities, groups of teachers, clubs, parents' associations, teacher unions, the media, commercial producers, and sometimes other non-educational public authorities, are all playing some role and investing some resources in the development of different literacies, different ways of learning and of accessing information, different bodies of knowledge and skills to acquire. The combination of these formal and informal, coordinated and haphazard initiatives, all reflecting particular expertise, motivation and interests as well as different histories of past experiences, results in national situations that are very varied in their outlook, in terms of content and scope, coordination, administration, juridical status, allocation of roles and responsibilities, and, finally, educational products made available to the clients: the pupils, the students and the public at large. Although their relative weight is difficult to assess with any degree of precision, a number of these "independent" developments seem to be comparable in their objectives, investments and results to the efforts deployed on a more formal basis. The link between what is done in and for the formal educational sector and what is developing elsewhere, and the impact of one kind of development on the other, are important issues to consider for education as they remain, for the time being, rather obscure.

Objectives and Priorities for Policy

8. The objectives at the basis of formal policy formulations are similar across countries in that they recognise the NIT as holding a great potential for education. But they do not necessarily take the same stance as to the specific contribution the technologies might make, as to whether technologies are to be included in the body of knowledge all citizens should have in order to function in society, whether the NIT are a matter to consider solely in terms of vocational education, whether the NIT hold a beneficial potential to the institution of education more than, or as well as, to the learner. The diversity of the objectives is reflected partly in the different approaches of the policies therein. If virtually all policies establish priorities, in the short if not in the medium term, they sometimes differ as to the definition of the entry point into the system. Two broad classifications of policy approaches can be developed in this respect. The first, defined in terms of the educational lines affected, covers two main groups of policies. The "vocational" group, most common in Member countries where the vocational education tradition is very strong, aims at introducing the NIT in vocational (commercial and technical) education to the exclusion of the general

educational sectors, sometimes earmarked for later investments. The "comprehensive" group of policies, on the contrary, does not privilege one sector over the other. Policies of this kind are more common in countries where the vocational and general educational sectors are formally merged within postcompulsory provisions or where the vocational tradition is not particulary strong within formal education.

9. A second broad classification of policies can be defined in terms of the priorities established for public investments and responsibilities by "front". Whatever the educational line adressed, the introduction of the NIT in education involves developments at different levels, such as equipment, curriculum and software and teacher training. Only a few of the national policies developed so far cover the totality of these critical fronts. Most of them establish public responsibilities within an explicit or implicit priority list, by front. Some of the policies consider that governments have a main responsibility in the equipping of educational establishments (either directly, by providing the hardware, or indirectly, through mechanisms of financial support targetted at purchase), or in providing financial and logistic support for curriculum development. Fewer policies target governamental involvment to the production and/or diffusion of software or at least to the coordination of its production/diffusion on a national basis. Yet fewer policies, although recognising it as an important issue, have devoted the bulk of the public resources available to the development of teacher training provisions. Each one of the above differences can be expected to have consequences on the education provided as well as on the evolution of the institution itself, at least in the short and medium range.

The Link with Industrial Development

10. Besides these differences, two broad similarities can be recognised across policies. One is the strong link of educational policies to national policies of industrial development: the equipment for which governments take financial or administrative responsibility is usually produced nationally. Countries where technologies other than microcomputer technology (usually telecommunication technologies) are the object of public investments in education are those where these other technological sectors have been given high national priority in industrial development. To the extent that the latter usually lean on weak pedagogical grounds, these links raise important issues for the possible impact of the technologies thus selected on the former.

Flexibility and Uncertainty

11. The other similarity concerns the life-time of policies. Usually, national policies have been formulated as short term, with a maximum time perspective of five years. At times this corresponds to explicit policy strategies. In some countries, central authorities act as supporters and initiators with a view to handing over to local authorities their commitments and responsibilities after an initial launching period. In other countries, the short-term policy formulations correspond to a two-phase policy design: a first period of controlled experimentation followed by a longer phase of large scale diffusion into main stream education, which might or might not involve a shift of roles and responsibilities between central and peripheral authorities. Yet in other countries, the short-term perspectives of the

policy are the ones usually adopted in similar cases, given the uncertainty, the risks and the difficulties of the task at hand. In these instances, the policies are explicitly marked as "first instalments", with an explicit committment by the educational authorities to review the situation at the end of the period although with no indications as to the life-time expected for the more "mature" policy decisions. Obviously, these different approaches to time differentiate policies in their degree of rigidity and flexibility as generators of answers to the questions, continuously changing and multiplying, raised for education by the impact of the NIT on all sectors of society. Such emphasis on uncertainty -- of objectives as well as of practice -- as a basis for policy is a major issue to consider in this field.

The Cost/Benefit Argument

12. As policy objectives are identified and resources allocated to implementing them, the economic concerns grow stronger. How much will it all cost? For what benefits? Who will pay? For how long? The introduction of the new information technologies in education is already showing the (important) breadth and depth of the processes involved, their (long) time span, and the amount of resources likely to be needed on the way -- much larger than the initial investments by governments. Yet, despite the clarity of such emerging trends, the task of assessing costs and benefits remains difficult to the economist. Most of the available data are on expenditure rather than costs. In particular, virtually no information exists on opportunity costs. Little is known on the amount of resources invested by non-public, non-formal bodies in this area. The balance between public and private expenditure is therefore obscure as is its possible evolution. Furthermore, the much voiced argument of the irresistible decline of hardware prices -- a weighty item in the expenditure bill -- is losing ground as the new production seems to obey a different evolution of the market, with the price-to-power ratios decreasing more often than the prices.

13. To complicate matters, the "benefit" side of the equation is proving to be as elusive as the "cost" one. Some of the reasons are familiar. They are raised by those who see the functions of education in larger terms than just teaching and learning, thus making eventual "technological" benefits hard to assess. Other reasons are novel as they relate to some of the specific approaches taken by policy. A case in point in the current emphasis of investments in the education of specialised manpower. The trend, already strong in schools, is dominant in higher education. Given the current uncertainties in medium and long-term forecasts for specialised manpower -- for technicians and, especially, for professionals -- the "benefits" attached to current priorities in investments would tend to look even more uncertain.

III. OUTCOMES AND PRODUCTS

14. As an outcome of both policy and grassroot developments, a number of changes have occurred in are taking place in educational provisions concerning the NIT available in and out of schools, to the young as well as to the less young. The result is, for the time being, an array of provisions marked by a

high degree of variability at a number of levels: by countries, districts and schools, by curriculum, educational objectives and target groups. The variations observed correlate only modestly with the pre-existing differentiations of educational provisions and outcomes. In other words, the first generation of such "new", NIT related, educational provisions seems to have increased the degree of differentiation within the system, rather than the opposite. While this is not necessarily an issue in itself -- it might be a temporary condition or even correspond to a welcome evolution -- it is important to identify the various factors contributing to it with a view to understanding the possible implications for the future of education and the place of information technology within it.

Hardware and Software

15. On the equipment front, the current flow of hardware into the schools tends to be characterised by a narrow selection in terms of technology and a large one in terms of corresponding hardware. The material purchased in the larger numbers belongs to the family of computers. Other information technologies, such as telecommunications or optic fibres and cable technology are much less represented in both schools and universities, although the trend is stronger in the former than in the latter. The work stations usually found in educational establishments include micro or minicomputers, display screens, disk drivers, and printers. At times the configuration is linked to data bank networks, link-ups with video components such as videodiscs being rarer. Hardware configurations for distance education -- satellite, cable telecommunication -- are being introduced in some Member countries. In the majority of them, however, such equipment remains marginal to current policies and investments in education.

16. The hardware entering education in less formal ways tends to reflect a similar trend. Public and "grassroot" developments thus combine to enhance the same technological bias in education. To the extent that "computer power" sets boundaries to what can be achieved in terms of pedagogy, the selection of this particular type of technology introduces an important bias in the possible array of large-scale utilisations of the NIT in education. The type of computers found most often in schools are among the least powerful of the family that allows the more sophisticated pedogogical approaches. Their pedagogical applications are therefore also limited. The latest generations of micro and minicomputers, offering more "computer power" for the same price, can eventually offset the drawback in hardware. It remains to be seen if, when and how education can develop equipment policies and practices resourceful enough and flexible enough to increase its own "pedagogical power" accordingly.

17. The fact that they are of the same breed, does not necessarily make school computers uniform. In the absence of agreements and regulations on standards or standardisations, these computers tend to come in a number of models, each providing different performances, thus different advantages and drawbacks in their educational applications. Despite the (sometimes) unifying impact of official policies on equipment, the variety of the electronic market tends to be reproduced in educational establishments. This may possibly facilitate the tuning of the hardware to the specific needs of individual schools. Undoubtedly, it also creates important obstacles to the optimal utilisation of the capital of software produced in each country by aggravating problems of transportability across hardware.

Information Technologies in Education

18. The lack of transportability across hardware is only one of the several factors beleaguering the introduction of the NIT in education. More importantly, little consensus has emerged as yet as to the future role of the information technologies in education. Some educators and some schools view the computer as just another learning tool, one that will be important for instruction insofar as it facilitates teaching and learning, without necessarily taking any prominent place in the classroom. Others believe that the computer can make the dream of modern pedagogy come true: an individualised instruction and tutoring for all pupils and all students, at no extra cost for education. Yet others claim that the largest impact of the NIT will be on teachers, on their role and functions, on their numbers. Others still look wearily upon the computer as a gateway through which a new form of culture might come into the schools, a body of knowledge and skills defined -- perhaps -- in less than "human" terms.

19. Little of what is concretely happening in education provides enough information to tilt the debate in any one direction. For one, the information is in itself scarce. Not enough schools are sufficiently equipped to provide substantial grounds for experimentation. A common feature found in Member countries is of an average of a few micro or minicomputers per secondary school, with an average access time to students of less than half an hour per week. Usually primary schools are even less well equipped and vocational ones much better, especially in some sectors. In the latter, a number of countries are achieving an equipment target of a workstation for each ten, or fewer, students. In most schools, the few computers available are used essentially for drill-and-practice or remedial education, rather than as an aid to teaching, although examples of the latter are on the increase.

Computer Science in the Curriculum

20. In addition to being used as a tool for teaching and learning within established disciplines, computers are also being used as a teaching subject in its own right. This educational objective, common to most of the schools equipped with computers and to some of the others too, has translated, again, in a variety of educational provisions, which, especially in general educational lines, are difficult to accommodate within a single taxonomy. At times, teaching about computers is taken to mean the introduction of elements of computer science in established disciplines, at times the same subject matter is organised as a separate piece of the curriculum. At times it is the object of final examinations, at times it is not. At times it is enlarged to include considerations of the societal implications of the NIT, at times it is limited to computer programming, often to only one programming language. These variations co-exist in some countries, sometimes in the same educational line, and usually irrespective of the level of schooling considered. The only pattern showing some degree of consistency is the heavy bias of computer-related educational provisions in favour of the secondary as opposed to the primary educational level. This bias in curriculum is obviously reinforced by the equivalent imbalance in equipment.

The "Remote Control" on Education

21. One way to look at the present situation is to see education as engaged in a vast exercise of trial and error. To the extent that the ultimate objectives are reasonably clear and the processes under control, we might be witnessing a first exploratory phase of development, marked by a healthy degree of uncertainty, progressing towards a clear future. In this case, the work agenda of all those concerned would not differ much from that of other times on other changes. It would then be reasonable to expect that the issues be defined within education and the problems solved by members of the educational community. The reading could however be different. The variations and uncertainties observed in the response of education to the information technologies could stem from elsewhere, from sectors of development obviously related to education but eluding its authority.

22. The existence of such "remote control" on educational developments is an important issue to debate. Next to the influence of technological and industrial developments, other obvious candidates could easily be found in the sectors of software development and research on learning processes and applications of artificial intelligence. On the software front, most of the software used in education is that which has been produced within the system, by schools or by bodies especially created within educational authorities, with teachers as the main authors. With very few exceptions, commercial producers and research bodies specialised in computer sciences, whether or not linked to higher education institutions, have not taken a prominent role in the educational market. The quality of the results is recognised to be, at best, varied. The best type of educational software, the more sophisticated and sound pedagogically, tends to be the more costly to produce, drawing on the combined expertise of computer specialists, educators, cognitive psychologists, and software designers. This type tends also to be scarcer on the market compared with the more common kind built on rather unsophisticated programming and directed at lower level cognitive skills, such as drill and practice, enrichment and remediation. Issues of expertise, of costs and financing, of quality control, of copyright and of transportability are at the centre of current developments in the software area. They point to factors of variation within the market, which cannot but be reflected in education.

Impact on Learning

23. In addition to such technical issues, another major source of uncertainty in the introduction of the NIT in education lies undoubtedly within the area of research, marked by the lack of adequate information and understanding on what learning entails in terms of skills and processes as well as on the possible role of the technologies therein. The introduction of the NIT in the learning environment has been observed to lead -- although not systematically and according to modalities still uncharted -- to changed learner performances. The observed changes suggest some modification of the learning processes and of their cognitive and motivational determinants. In particular, the observed results throw doubts on some of the assumptions at the basis of current curriculum organisation, i.e. at what age one can expect formal reasoning abilities to develop, at what speed certain notions and skills can be learned. It is also observed that, similarly to what has been observed with other learning methodologies, the benefits of learning via the NIT are not equally distributed across the population. Such seemingly

unsurprising results become intriguing when noting that the profile (cognitve and motivational make-up) of the better performers does not necessarily reproduce the familiar profile of the "good achievers". For instance, good performance with the NIT has not been found to correlate to any conspicuous degree with "classic" indicators such as socio-economic background, sex, or mathematic abilities.

24. The implications of these findings might be far reaching for education, for its content as well as its organisation. If the NIT were spread evenly across the school population, the issue could then be raised of how the "profile" of the "new" achievers compares with their former profiles and of what the implications are in social and political terms, of how the curriculum should be re-organised across levels of schooling, across pupils' ages, across disciplines. Yet, without adequate information from research, these questions will remain unanswered, the implications for education uncertain, the degree of variation across educational provisions undiminished.

25. As long as a "critical mass" in production and understanding is not reached in the areas of software development and cognitive sciences, it could be argued that the introduction of the NIT in education is bound to remain limited to a level which is perhaps unjustifiable an a cost/efficiency basis. In particular, there will be no easy way to address the basic issue of what can and what cannot be achieved in education by way of the new information technologies. Yet, the list of possible benefits to draw from the information technologies -- from gains in learning and in access to learning facilities to the expansion of alternative ways of learning, such as distance education or through self-learning opportunities -- is appealing enough to warrant the effort of finding out. Waiting for a large enough body of information to accumulate, what remains to be discussed still is the role education could or would be prepared to play in this process.

Teacher Roles and Teacher Training

26. Besides the possible decisions taken by the educational authorities at the highest levels on the matter, the role that teachers are willing to play and the contributions they might be able to make remain central to this context. Yet compared with developments in equipment, software and research, the issue of teachers qualifies so far as having received much more of the attention than of the resources. The debate on the roles and functions of the teachers has taken momentum in a number of countries, yet only in very few of them teacher training provisions, to mention but a component of the problem, have been developped that meet the challenge. In these countries the target is set to cover, over only a few years, the totality of the teaching force or of at least some sectors in it, usually those in vocational education. Most of the other countries have either no formal provisions to report or only modest ones to show, aimed at yearly targets of no more than a few percentages of the teaching force. The more recent production of multimedia programmes for self-training, which can be run on the hardware commonly available in the school, could perhaps help solve this problem of numbers.

27. In the debate on teacher training, the issue of quantity is paralleled by that of quality. When they exist at all, teacher training provisions tend to be undifferentiated by level of education or by discipline. Furthermore, they do not distinguish among possible roles or functions with respect to the

use of the NIT in education. Finally, the large variety in the length and content of the existing courses indicates that the consensus, if not the understanding, is far from being reached across countries on what teachers are supposed to know, or able to assimilate, on the NIT. The uncertainty of the trend might however dissipate in not so distant a future. Both the grassroot and the more advanced formal developments in this area identify some new roles possibly emerging for the teacher. Roughly put, the trend points to the development of a "coordinator", a teacher having undegone, formally or informally, a training "heavy" enough to make him/her able to take the lead in schools. This teacher is the one observed to launch and maintain activities related to the NIT as a trainer of colleagues, as a producer of software, as organiser of extra-curricular activities for teachers, youngsters and the community at large. Interestingly enough, the "coordinator" seems to emerge irrespective of the existence of a formal level of employment corresponding to this new profile of competences and responsibilities, located somewhere between the ordinary teacher and the school head.

Computers and Social Control

28. While education is engaged in defining and (possibly) solving its own internal problems of curriculum and staff development, instruction in and by the NIT is also growing in the outside market. Additionally to the ad hoc training provisions developing in the economy, in both the service and the production sectors, the general trend is for a proliferation of provisions and opportunities made available to the general public by a variety of sources -- government, media, private sector, associations networks, social and cultural agencies -- these different bodies coming together occasionally for specific ventures. Like that in education, this production is also marked by a high degree of internal variation. At best, it provides a real, at times even a better, alternative to instruction within formal education. At worse, it offers informal and disorderly opportunities aimed at "overtaking" its target learners, to create in them artificial needs and to encourage them to consume products, the quality of which remains to be evaluated.

29. The existence of such "parallel" arrays of provisions is undoubtedly an element to consider when planning and implementing educational developments in the area of the information technologies. Its consequences for the role and responsibilities proper to education are questions open for discussion. The so called "computer literacy" is a most obvious first item on the list. Taken in its narrower definition of basic learning about the computer, it is perhaps debatable whether education should necessarily take the lead on more informal or private initiatives. But, to the extent that "computer literacy" might mean the acquisition of the ability to take advantage of the new information facilities without succumbing to their control -- a concern expressed by many -- the debate on the role and responsibility of education takes a more dramatic connotation. In this context the issues of public versus private and formal versus informal might mean to the learner the difference between using and being used.

IV. FUTURE WORK AGENDA

30. Given the general trend in the diffusion of the new information technologies in society, it is difficult to imagine that education could either remain marginal to the general climate of change, or survive unchanged in its structure, organisation and functions. Put differently, it is hard to believe that the forces behind the impact of the NIT on economic, social and cultural life could suddenly deflate at the doorsteps of our schools and universities. Indeed the signs indicate that the "technological revolution" has already made an inroad in education which might well be irreversible . The evidence also suggest that the process thus started, if sustained to its full institutional implications, is likely to be long, costly, complex and far reaching. In other words, the central issue to discuss is more likely to be one of "when" and "how" rather than "if" education will face the challenge.

The Achievement of "Critical Mass"

31. The issue of "critical mass" has come forcefully to the fore of the analysis as a first general and urgent objective to achieve. More equipment is needed in educational establishements, more research is needed on the impact of the NIT on learning and on the organisation of education. More trained teachers are needed, more pedagogical experimentation in the classrooms is necessary. More software of a higher quality for education needs to be developed. The level and quality of resources and expertise needed to achieve the objective surpass what can be found within any single educational system, or single regional authorities. It is even debatable whether they can be found solely within the public sector, in each country. Specific efforts of coordination and cooperation at national and international levels as well as across agencies and professional sectors seem to be urgent and necessary to achieve progress in education.

The Development of Evaluation

32. The need to accumulate experience and information is paralleled by the need to evaluate them. The technologies risk to introduce a bias of their own in teaching as well as in learning. They might privilege the development of those teaching methodologies and learning skills to which they apply. They might act as a distorting filter on the body of knowledge made available through them to pupils, students and the general public. The evaluation data produced so far has tended to be scarce and biased. We are informed about positive results much more often than about the others. We know little of the "technological" conditions that make no difference, and even less of what could be detrimental to learning or education.

The Prevention of Inequalities

33. Few of the OECD Member countries have enough resources to be able to solve all the problems rapidly or simultaneously. The trend in future developments is more likely to be one of establishing priorities. Depending on the ranking order adopted in each country, the issue that risks becoming central to policy and political considerations might well be that of access.

The response of education to the technologies is already showing patterns of differential access across recipients. The dividing lines are often familiar: rich vs poor schools, urban vs rural establishments, vocational vs general, secondary vs primary education, science vs humanities, boys vs. girls. The boundaries do not seem to be conspicuously different in higher education. The danger is already visible that efficiency could be achieved at the price of equity and equality.

The Need for Careful and Coordinated Policy Planning

34. The role of government will remain crucial in the near future to decide on courses of action, by defining objectives for policies and allocating responsibilities and resources for their implementation. In particular, it will remain as its responsibility to see that the interplay between the various agencies, public and private, formal and informal, develops constructively, and that the new objectives possibly established for education continue to reflect the mandate towards its customers. The new information technologies are the gateway to the society of the future, just as the industrial revolution was to the present one. That transition has improved people's life in many important respects, but this progress has not been free of costs. There are no reasons to expect that the "technological revolution" will give or take any less. A central question, therefore, is to what extent governments are prepared to use the authority and coverage that they have since gained over economic, social and educational matters to ensure appropriate control over the new developments so that the ultimate balance be a fair one.